Stabilization and Beneficial Use of Contaminated Sediments Applying Mobile Pneumatic Flow Tube Mixing for a Circular Economy

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Introduction: Beneficial use of dredged sediments has been widely accepted in concept and practice and has recently been incorporated into the Circular Economic Paradigm. Sediments move with tides, currents, and storm events and are transported across watersheds and geographical (state and country) boundaries. Clean sediments are available for a multitude of beneficial use applications. The paradox is that, from a regulatory perspective and due to negative public and industry perceptions, contaminated sediments are treated differently. They are usually not included in this equation, because they are generally considered to be waste products. Trans-disciplinary environmental engineering programs such as EcoShape and Engineering with Nature are excellent long-standing initiatives that contribute to a higher level of understanding of the beneficial use of mostly non-contaminated sediments. This work seeks to operationalize a circular economic model for contaminated sediments applying Pneumatic Flow Tube Mixing (PFTM) stabilization.

Challenge: To address the regulatory and perception challenges facing the beneficial use of contaminated sediments, the Central Dredging Association (CEDA) Beneficial Use Workgroup developed a position paper on this topic - the *Beneficial Use of Contaminated Sediments* which will be published in 2018. Within the context of the position paper, applying innovative treatment technologies allows contaminated sediments to be factored into the circular economy. Stabilization technologies are a well-established strategy for the treatment of contaminated sediments, soils and several other waste materials. They have been shown to be effective for a wide variety of organic and inorganic contaminants while providing environmental and structural applications for sustainable beneficial use. One of these technologies (presented here) is self-contained and does not produce environmental impacts such as discharges into air or water thereby eliminating much of the regulatory and perception challenges.

Technology: PFTM is an innovative ex-situ stabilization process which has been successfully used in Japan in large scale reclamation projects and in a recent commercial demonstration in New Jersey, USA as well as in Italy. It is used to stabilize soft contaminated sediments with Portland cement. The sediment and binder are mixed and transported using compressed air to produce a stabilized flowable fill. The PFTM footprint is relatively small so that it offers deployment options not realized with conventional processes.

Innovation: This PFTM process has been designed for a mobile barge system (MObile Sediment Engineering System (MOSES)) which has further advantages for deployment and end-use applications. Processing at a docked fixed facility or directly at dredging sites where structural/non-structural flowable structural fill material is needed for beneficial use upland placement. It will reduce the need for long-distance transport and secondary handling. The stabilized sediment can be pumped up to 1.6 km from the shoreline or barge to a project site, takes the place of large-scale mechanical / geotube dewatering equipment.

These material handling capabilities provide a distinct role in aging-infrastructure urban sediment management environments where staging areas are limited and/or located in densely populated residential communities. Port development and expansion, bulkhead backfills, brownfields and Municipal Gas Plant remediation, reducing sediment loads behind dams and coastal restoration/resiliency including berm construction for flood control are potential beneficial use applications. PFTM/MOSES is a platform that can be deployed to a diverse array of maritime project-specific locations allowing this innovative sediment strategy to become a catalyst for regional economic growth. Utilizing stabilized contaminated sediments with a high beneficial use value can drive a circular watershed economy specifically in urban and coastal systems.